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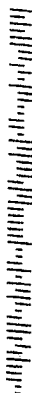


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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/664,453	09/18/2003	Nipun Gopaldas Gupta	285.069	4360

7590 04/14/2005

Charles A. Muserlian
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600 Third Avenue
New York, NY 10016

EXAMINER

JIANG, CHEN WEN

ART UNIT	PAPER NUMBER
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3744

DATE MAILED: 04/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/664,453	Applicant(s) GUPTA, NIPUN GOPALDAS	
	Examiner Chen-Wen Jiang	Art Unit 3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 8-13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1,2,3,4,5,6,8 and 13 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Nishizawa (JP 2001050600).

Nishizawa discloses an evaporation type condenser. English translation (machine) is provided for Applicant. Referring to Fig.1, Drain water condensing on the surface of the evaporator 50 is collected in a drain pan 74 and is sent out to the condenser 54 by a drain pump 82. The drain water is sprayed over the condenser 54 from a spray unit 88. Drain pan 74 and reservoir 76 are associated with the evaporator 50 and condenser 54, respectively. A split air conditioning system consisting of an indoor evaporator unit 50 having a water drain 74,86 extending from the evaporator coil and an outdoor condenser unit including a compressor 52 and a condenser coil 54, characterized in that at least a portion of the water flowing through the water drain 74,80 of the indoor unit is lead led to the condenser coil of the outdoor unit for cooling of the condenser coil.

3. Claims 1,2,3,5,6,9,10 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Holstein et al. (U.S. Patent Number 6,318,108).

Holstein et al. disclose a self-washing and cool coil for air conditioner. Referring to Figs. 1, 2, 3 and 10, the air conditioning system includes an exterior condenser having a heat exchange coil 18. Spray head 22 on the condenser is arranged to spray water from a water supply onto the heat exchange coil. A control device periodically energizes the water supply whereby water is supplied to the sprayhead and onto the exchange coil to cool the coil. **The water supply may comprise a condensate reservoir and pump 14 assembly, and conduit for delivery of condensate from the drain of an interior evaporator to the reservoir** (water flowing from the water drain 12 of the indoor unit 10 to lead to the outside coil 18). Alternatively, the water supply may comprise tap water under pressure. When condensate is used, tap water under pressure may serve as a supplemental supply to the reservoir. An adjustable flow-restricting device 62 is installed on the water supply line 54. The conduit between the reservoir and the sprayhead are sealed and the sprayhead 22 is perforated.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nishizawa (JP 2001050600) or Holstein et al. (U.S. Patent Number 6,318,108).

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The O and D shaped condenser elements as art recognized equivalents and commercial available, it would have been obvious to one of ordinary skill in the exercise art to substitute one for other. In re Fout, 675 F.2d 297, 301, 213 USPQ 532, 536 (CCPA 1982).

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chen-Wen Jiang whose telephone number is (571) 272-4809. The examiner can normally be reached on Tuesday-Friday from 8:00 to 6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Denise Esquivel can be reached on (571) 272-4808. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chen-Wen Jiang
Primary Examiner

A handwritten signature in black ink, consisting of a stylized 'C' followed by a series of loops and a final horizontal stroke.

Notice of References Cited	Application/Control No. 10/664,453	Applicant(s)/Patent Under Reexamination GUPTA, NIPUN GOPALDAS	
	Examiner Chen-Wen Jiang	Art Unit 3744	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	JP 2001050600 A	02-2001	Japan	NISHIZAWA, KAZUO	F25B 01/00
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

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特開2001-50600

(P2001-50600A)

(43) 公開日 平成13年2月23日 (2001.2.23)

(51) Int.Cl.

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識別記号

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テーマコード(参考)

3 8 1 Z

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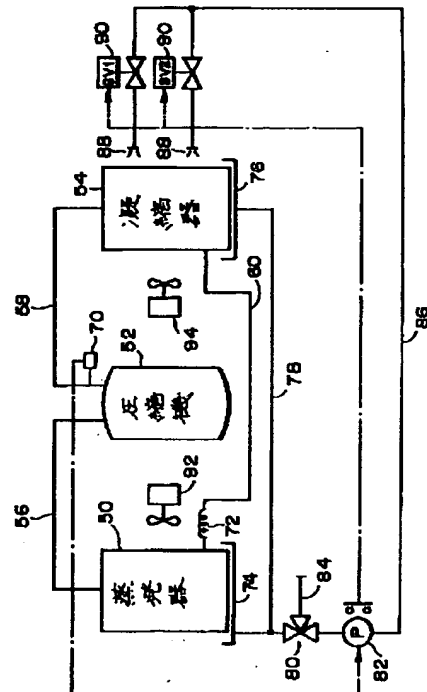
弁理士 吉田 研二 (外2名)

(54) 【発明の名称】 冷凍装置

(57) 【要約】

【課題】 蒸発式凝縮器を有する冷凍装置において、水道水に含まれる硬質スケールが凝縮器に付着することにより省エネルギー効果が劣化する。

【解決手段】 蒸発器50の表面に凝結するドレン水を受水皿74に集める。例えば外気温度が高くなると通常の運転では装置の消費電力が許容範囲を越えうる。この場合を、高圧圧力スイッチ70が圧縮機52の高圧側圧力が設定値を越えたことに基づいて検知し、受水皿74に溜まったドレン水をドレンポンプ82で凝縮器54側に送出する。このドレン水は高圧圧力スイッチ70に連動して開状態とされた電磁弁90を介して散水器88から凝縮器54に散布される。



【特許請求の範囲】

【請求項1】 蒸発器と凝縮器とを含む冷凍装置において、前記蒸発器表面にて空気中の水蒸気が凝結して生じる凝結水を集めて、前記凝縮器表面に散布する凝結水散布手段を有することを特徴とする冷凍装置。

【請求項2】 請求項1記載の冷凍装置において、前記凝結水散布手段は、前記蒸発器側にて集められた凝結水を前記凝縮器側へ導く配管と、当該配管に設けられ凝結水を前記凝縮器側へ送出するポンプと、前記配管の前記凝縮器側の端部に設けられた散水器と、を有することを特徴とする冷凍装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、冷凍装置に関し、特にその冷却効率の向上に関する。

【0002】

【従来の技術】冷凍装置においては、蒸発器で気化した冷媒が、凝縮に十分な圧力にまで圧縮機によって圧縮される。この圧縮され高温高压ガスとされた冷媒は、凝縮器にて冷却されて液化され、再び蒸発器へ供給される。凝縮器にはファンが設けられ、このファンによって冷媒ガスが通される冷却管の表面へ送風することにより、冷媒ガスの冷却が行われる。ここで、冷却管に水を散布し冷却管の表面を潤して、ファンによる送風を行うことにより冷却効率が向上することが知られている。ちなみに、このような凝縮器は蒸発式凝縮器と称される。

【0003】図3は、蒸発式凝縮器を用いた従来の冷凍装置における冷凍サイクルの概略の構成図である。上述したように、この装置の冷凍サイクルは、蒸発器2、圧縮機4、凝縮器6を含み、互いが配管8によって接続され、この配管8の中を冷媒が流通する。凝縮器6に送風するファンとして室外ファン10が、また蒸発器2に送風するファンとして室内ファン12が設けられている。また凝縮器6の近傍には、外気温度を検出する温度センサ14が設けられる。凝縮器6に向けて散水器16が設けられ、この散水器16は、電磁弁18及び給水管20を介して上水道に接続される。電磁弁18は温度センサ14の出力に応じて開閉される。蒸発器2の下方には受水皿22が配置され、蒸発器2に凝結して滴下するドレン水（凝結水）はこれに受けられる。受水皿22に滴下したドレン水は排水管24を介して排水される。

【0004】次に、この従来の装置の動作を説明する。凝縮器6に高温高压の冷媒ガスを導き、室外ファン10を運転して凝縮器6に送風する。送風された空気は凝縮器6における放熱を促進し、その凝縮器6内において冷媒ガスは熱を奪われ凝縮する。

【0005】温度センサ14は外気温度を検出し、設定

温度以上となると電磁弁18を開き、散水器16から凝縮器6の表面に水道水が散布される。これにより、室外ファン10のみの場合よりも凝縮器6における放熱が更に促進され、外気温度が高い場合において室外ファン14の消費電力の増大を抑制しつつ、冷凍装置の冷却効率の低下を防止することができる。

【0006】

【発明が解決しようとする課題】従来の蒸発式凝縮器に用いられていた水道水は硬質スケール成分である溶解塩類（ Na^+ 、 Ca^{++} 、 Cl^- 、 SO^{--} 、 HSiO_3^- 等）を含む。そのため、従来の蒸発式凝縮器では長く使用するうちに冷却管の表面にスケールが付着し、冷却管を介した冷媒ガスから外部への伝熱効率が劣化して、冷却効率の改善の効果が低減するという問題があった。また、水道水のコストが発生するため、散水による消費電力低減によるコスト低減効果が薄れるという問題もあった。

【0007】本発明は上記問題点を解決し、蒸発式凝縮器による冷却効率改善の効果が持続し、また省エネルギー効果が得られる冷凍装置を提供することを目的とする。

【0008】

【課題を解決するための手段】本発明の冷凍装置は、蒸発器表面にて空気中の水蒸気が凝結して生じる凝結水を集めて、当該凝結水を凝縮器表面に散布する凝結水散布手段を有する。

【0009】蒸発器の周囲の空気は蒸発器によって冷却される。このとき、空気中に含まれる水蒸気が蒸発器表面に凝結する。本発明によれば、この蒸発器表面に凝結した水が凝縮器に散布されることにより蒸発式凝縮器が構成され、凝縮器における冷媒の冷却効率が向上し、消費エネルギーの低減した冷凍機が実現される。ここで、空気中の水蒸気には基本的に硬質スケール成分は含まれないため、その凝結水を凝縮器に散布しても凝縮器表面にスケールが析出・付着することがない。

【0010】本発明の好適な態様は、前記凝結水散布手段が、前記蒸発器側にて集められた凝結水を前記凝縮器側へ導く配管と、当該配管に設けられ凝結水を前記凝縮器側へ送出するポンプと、前記配管の前記凝縮器側の端部に設けられた散水器とを有するものである。

【0011】

【発明の実施の形態】次に、本発明の実施形態について図面を参照して説明する。

【0012】図1は、本発明の実施形態である冷凍装置における冷凍サイクルの構成図である。この装置の冷凍サイクルは、蒸発器50、圧縮機52、凝縮器54を含む。蒸発器50と圧縮機52、圧縮機52と凝縮器54はそれぞれガス配管56、58によって接続され、凝縮器54と蒸発器50は液配管60によって接続される。ガス配管56、58は、蒸発器50で発生した冷媒ガスを圧縮機52を経由して凝縮器54に導き、液配管60

は凝縮器54で生成された冷媒液を蒸発器50に導く。

【0013】ガス配管58には、当該配管内の圧力が設定値以上になったことを検知する高圧圧力スイッチ70が設けられる。また、蒸発器50の入り口の直前の液配管60には、膨張弁72が設けられている。膨張弁72は、高圧の冷媒液を絞り膨張により減圧して気液混合状態の低温低圧の湿り蒸気とする。

【0014】蒸発器50、凝縮器54のそれぞれの下方には受水皿74、76が配置される。この受水皿74、76は、後述するようにそれぞれ蒸発器50、凝縮器54から滴下する水滴を受けるものである。受水皿74、76によって集められた水はそれぞれ集水管78に流れ込む。

【0015】集水管78には切り替え弁80が接続され、この切り替え弁80は集水管78に流れ込んだ水の行き先をドレンポンプ82か排出口84かのいずれかに切り替えることができる。

【0016】ドレンポンプ82は高圧圧力スイッチ70からの信号に基づいて動作し、受水皿74、76から流れ込んだ水を給水管86を介して散水器88へ送出する。散水器88への給水は、電磁弁90により制御される。この電磁弁90は高圧圧力スイッチ70からの信号に基づいて、ドレンポンプ82に連動して開閉される。

【0017】なお、蒸発器50に送風するファンとして室内ファン92、また凝縮器54に送風するファンとして室外ファン94が設けられている。

【0018】次に、この冷凍装置の動作を説明する。蒸発器50には、上述したように膨張弁72にて膨張され低圧とされた冷媒液が供給される。冷媒液は蒸発器50の中の冷却管を通される際に、室内ファン92から送風される空気から熱を奪って蒸発し、この冷却された空気が室内へ供給されることにより、冷房等を行うことができる。なお、空気との接触面積を大きくして伝熱効率を高めるために、冷却管には細い管が用いられる。空気が蒸発器50により冷却されることにより、当該空気の飽和水蒸気圧は低下する。飽和した水蒸気は冷却管の表面に結露し、この結露は成長すると水滴となって冷却管から滴下する。蒸発器50の下方に配置された受水皿74は、この空気中の水蒸気が凝結した水滴を受け集める。

【0019】蒸発器50にて蒸発してガス状態となった冷媒は、ガス配管56を介して圧縮機52に導かれる。圧縮機52は外部動力源によって駆動され、冷媒ガスを断熱的に圧縮して過熱状態の冷媒ガスとする。ちなみに圧縮機は、往復動式、回転式、スクリュウ式といった種類に大別されるが、ここで用いられる圧縮機52には必要とされる冷凍能力などの条件によって好適なものを選定され使用される。

【0020】圧縮機52で過熱状態とされた冷媒ガスはガス配管58へ送出される。このガス配管58の他端は凝縮器54につながっている。凝縮器54は、蒸発器

で生じた冷媒ガスから大気への放熱を行い、冷媒ガスを液化して冷媒液とする。凝縮器54中の冷媒が通される管又は容器の外表面に対しては、室外ファン94から送風され、これにより、蒸発器で生じた冷媒ガスから大気への放熱を促進する。凝縮器54で生じた冷媒液は液配管60を通して蒸発器50へ導かれる。

【0021】さて、外気温度が上昇するに伴って、凝縮器54における冷媒から大気への放熱効率が低下し、凝縮器54における冷媒の液化の効率も低下する。凝縮器54の効率が低下するとガス配管58内の冷媒の圧力が上昇する。本冷凍装置では高圧圧力スイッチ70が、圧縮機52の吐出圧力が予め設定された閾値以上となったことに基づいて、外気温度上昇に伴う凝縮器54の効率低下を検知する。

【0022】高圧圧力スイッチ70は、凝縮器54の効率低下を検知すると、切り替え弁80を制御して、集水管78をドレンポンプ82に接続させると共に、ドレンポンプ82の起動、及び電磁弁90の開状態への制御を行う。これにより、空気中の水蒸気が凝結し受水皿74に溜められたドレン水が散水器88へ供給され、凝縮器54の外表面に散布される。凝縮器54に水を散布することで、凝縮器54の冷却効率が向上し、また圧縮機52の出力側圧力が低下するので、室外ファン94や圧縮機52で消費される消費エネルギーが低減する。

【0023】図2は、圧縮機52の消費電力特性の一具体例を示す図である。図において、縦軸は消費電力の相対値を表し、横軸は圧縮機52の高圧側圧力を表す。図中の点線100は、散水器88からの散水を行わない通常運転時の消費電力特性曲線であり、一方、実線105は、散水器88からの散水を行う散水運転時の消費電力特性曲線である。通常運転に比較した散水運転による消費電力低減の効果は、高圧側圧力が大きいほど大きくなる傾向が見られる。本冷凍装置では、このような傾向を受けて、高圧圧力スイッチ70によって高圧側圧力が所定値以上の場合に散水運転を行うこととしている。ちなみに、その所定値を決定する際には、散水運転による圧縮機52の消費電力の低減効果だけでなく、他の要因も考慮することができる。例えば、ドレンポンプ82による消費電力は一般に圧縮機52の消費電力に比べれば小さいが、これを考慮に入れたトータルの消費電力に基づいて、散水運転を行うか否かの高圧側圧力の閾値を決定することとしてもよい。

【0024】散水器88から凝縮器54に散布されたドレン水は凝縮器54から滴下し受水皿76に受けられる。本冷凍装置では、この受水皿76に回収されたドレン水を集水管78にてドレンポンプ82に導き、凝縮器54への散布に再利用することができる。このドレン水の循環再利用により、例えば、蒸発器50が水蒸気の発生源のない締め切った室内に配置される場合のように、蒸発器50側で発生するドレン水の量に限りがある場合

においても、凝縮器54へのドレン水の散布による消費エネルギー低減動作を継続することができる。

【0025】なお、ドレン水が多量に発生する場合には、切り替え弁80を排出口84側に切り替えて、不要分のドレン水を廃棄し、受水皿74、76からドレン水が溢れることを回避することができる。また、空気中や蒸発器50、凝縮器54表面のごみ等がドレン水に混じり、配管系や散水器88の詰まりを生じることを防止するために、例えば受水皿74、76と集水管78との接続部分等にごみを除去するフィルタを設けることとしてもよい。

【0026】

【発明の効果】本発明の冷凍装置によれば、蒸発式凝縮器を構成するために凝縮器表面に散布される水として、蒸発器表面に凝結する空気中の水蒸気が利用される。この凝結水には溶解塩類が含まれないため、凝縮器表面に硬質スケールが付着して凝縮器内部の冷媒から外部への伝熱効率の低下が生じることが防止される。よって、本

発明による蒸発式凝縮器では、長期間使用してもその消費電力低減の効果が確実に発揮されるという効果が得られる。

【0027】また、凝結水を利用するため、水自体のコストが発生しないという効果もある。

【図面の簡単な説明】

【図1】 本発明の実施形態である冷凍装置における冷凍サイクルの構成図である。

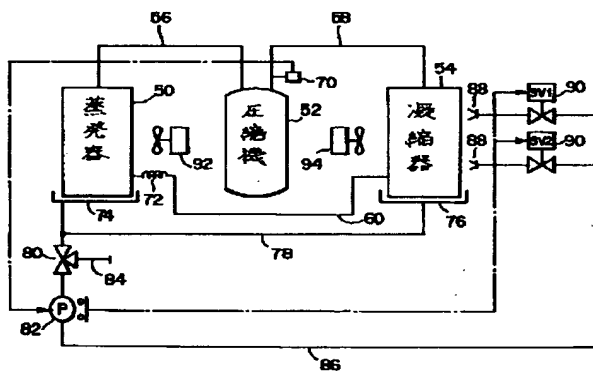
【図2】 圧縮機の消費電力特性の一具体例を示す図である。

【図3】 蒸発式凝縮器を用いた従来の冷凍装置における冷凍サイクルの概略の構成図である。

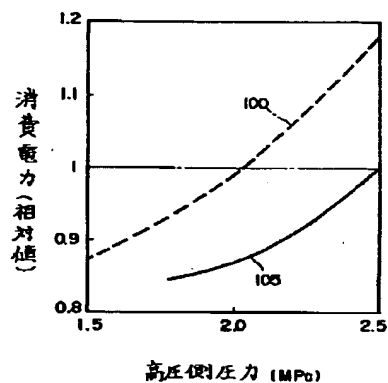
【符号の説明】

50 蒸発器、52 圧縮機、54 凝縮器、70 高圧圧力スイッチ、74、76 受水皿、78 集水管、80 切り替え弁、82 ドレンポンプ、88 散水器、90 電磁弁。

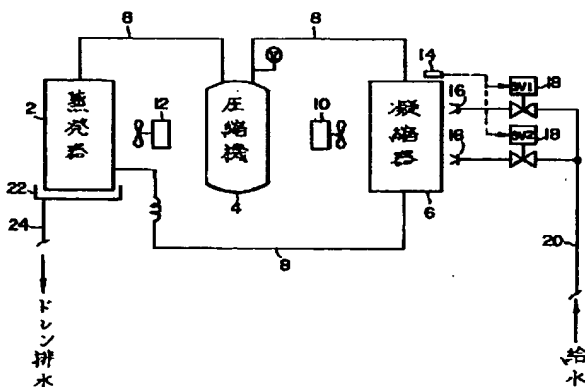
【図1】



【図2】



【図3】



PAT-NO: JP02001050600A

DOCUMENT-IDENTIFIER: JP 2001050600 A

TITLE: REFRIGERATING APPARATUS

PUBN-DATE: February 23, 2001

INVENTOR-INFORMATION:

NAME	COUNTRY
NISHIZAWA, KAZUO	N/A

INT-CL (IPC): F25B001/00

ABSTRACT:

PROBLEM TO BE SOLVED: To prevent the deterioration of an energy-saving effect due to sticking of a hard scale contained in tap water to a condenser, in a refrigerating apparatus having an evaporation type condenser.

SOLUTION: Drain water condensing on the surface of an evaporator 50 is collected in a drain pan 74. When an outdoor air temperature becomes high, for instance, power consumption of an apparatus may exceed an allowable range in an ordinary operation. A high-pressure pressure switch 70 detects this case from the fact that a high-pressure-side pressure of a compressor 52 exceeds a set value, and the drain water collected in the drain pan 74 is sent out to the condenser 54 side by a drain pump 82. This drain water is sprayed over the condenser 54 from a spray unit 88 through the intermediary of a solenoid valve 90 which is put in an open state, interlocking with the high-pressure pressure switch 70.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to improvement in the cooling effectiveness about a freezer.

[0002]

[Description of the Prior Art] In a freezer, the refrigerant evaporated with the evaporator is compressed even into sufficient pressure for condensation by the compressor. It is cooled and liquefied with a condenser and this refrigerant that was compressed and was made into elevated-temperature high pressure gas is again supplied to an evaporator. A fan is prepared in a condenser and cooling of a refrigerant gas is performed by ventilating the front face of the cooling pipe with which this fan lets a refrigerant gas pass. Here, it is known that will sprinkle water to a cooling pipe, will moisten the front face of a cooling pipe, and cooling effectiveness will improve by performing air blasting by the fan. Incidentally, such a condenser is called an evaporation type condenser.

[0003] Drawing 3 is the block diagram of the outline of the refrigerating cycle in the conventional freezer which used the evaporation type condenser. As mentioned above, including an evaporator 2, a compressor 4, and a condenser 6, each other is connected by piping 8 and, as for the refrigerating cycle of this equipment, a refrigerant circulates the inside of this piping 8. The indoor fan 12 is formed as a fan by whom the outdoor fan 10 ventilates an evaporator 2 again as a fan who ventilates a condenser 6. Moreover, the temperature sensor 14 which detects an OAT is formed near the condenser 6. A sprinkler 16 is formed towards a condenser 6 and this sprinkler 16 is connected to a water supply system through a solenoid valve 18 and a feed pipe 20. A solenoid valve 18 is opened and closed according to the output of a temperature sensor 14. The carrier water pan 22 is arranged under the evaporator 2, and the drain water (water condensation) solidified and dropped at an evaporator 2 can be received in this. The drain water dropped at the carrier water pan 22 is drained through a drain pipe 24.

[0004] Next, actuation of this conventional equipment is explained. The refrigerant gas of elevated-temperature high voltage is led to a condenser 6, the outdoor fan 10 is operated, and a condenser 6 is ventilated. The ventilated air promotes the heat dissipation in a condenser 6, in the condenser 6, heat is taken and a refrigerant gas is condensed.

[0005] If a temperature sensor 14 detects an OAT and becomes more than laying temperature, tap water will be sprinkled by the front face of a condenser 6 from an aperture and a sprinkler 16 in a solenoid valve 18. Decline in the cooling effectiveness of a freezer can be prevented the heat dissipation in a condenser 6 controlling [are promoted further, and] buildup of the outdoor fan's 14 power consumption rather than only the outdoor fan's 10 case, by this, when an OAT is high.

[0006]

[Problem(s) to be Solved by the Invention] The tap water used for the conventional evaporation type condenser contains the fused salt (Cl, -, SO Na+, calcium++, --, HSiO3-, etc.) which are hard scale components. Therefore, in the conventional evaporation type condenser, while using it for a long time, the scale adhered on the surface of the cooling pipe, the efficiency of heat transfer from the refrigerant

gas through a cooling pipe to the exterior deteriorated, and there was a problem that the effectiveness of an improvement of cooling effectiveness decreased. Moreover, since the cost of tap water occurred, there was also a problem that the cost reduction effectiveness by the power consumption reduction by water spray faded.

[0007] It aims at offering the freezer with which this invention solves the above-mentioned trouble, and the effectiveness of the cooling improvement in efficiency by the evaporation type condenser maintains it, and the energy-saving effectiveness is acquired.

[0008]

[Means for Solving the Problem] The freezer of this invention collects the water condensation which the steam in air solidifies and produces on an evaporator front face, and has a water condensation spraying means to sprinkle the water condensation concerned on a condenser front face.

[0009] The air around an evaporator is cooled with an evaporator. At this time, the steam contained in air condenses on an evaporator front face. According to this invention, when the water solidified on this evaporator front face is sprinkled by the condenser, an evaporation type condenser is constituted, the cooling effectiveness of the refrigerant in a condenser improves, and the refrigerator which consumption energy reduced is realized. Here, fundamentally, since a hard scale component is not contained, even if it sprinkles the water condensation to a condenser, a scale does not deposit and adhere in the steam in air on a condenser front face.

[0010] The suitable mode of this invention has piping for which said water condensation spraying means leads the water condensation collected in said evaporator side to said condenser side, the pump which is formed in the piping concerned and sends out water condensation to said condenser side, and the sprinkler prepared in the edge by the side of said condenser of said piping.

[0011]

[Embodiment of the Invention] Next, the operation gestalt of this invention is explained with reference to a drawing.

[0012] Drawing 1 is the block diagram of the refrigerating cycle in the freezer which is the operation gestalt of this invention. The refrigerating cycle of this equipment contains an evaporator 50, a compressor 52, and a condenser 54. An evaporator 50, a compressor 52 and a compressor 52, and a condenser 54 are connected by gas piping 56 and 58, respectively, and a condenser 54 and an evaporator 50 are connected by the liquid piping 60. Gas piping 56 and 58 leads the refrigerant gas which occurred with the evaporator 50 to a condenser 54 via a compressor 52, and the liquid piping 60 leads the refrigerant liquid generated with the condenser 54 to an evaporator 50.

[0013] The high voltage pressure switch 70 which detects that the pressure in the piping concerned became beyond the set point is formed in gas piping 58. Moreover, the expansion valve 72 is formed in the liquid piping 60 in front of the entry of an evaporator 50. An expansion valve 72 extracts high-pressure refrigerant liquid, decompresses it by expansion, and let it be wet steam of low-temperature low voltage of the vapor-liquid mixed state.

[0014] The carrier water pans 74 and 76 are arranged under [each] an evaporator 50 and the condenser 54. These carrier water pans 74 and 76 receive the waterdrop dropped from an evaporator 50 and a condenser 54, respectively so that it may mention later. The water collected by the carrier water pans 74 and 76 flows into the catchment tubing 78, respectively.

[0015] It changes to the catchment tubing 78, and a valve 80 is connected and this change valve 80 can change the destination of the water which flowed into the catchment tubing 78 to a drain pump 82 or an exhaust port 84.

[0016] A drain pump 82 operates based on the signal from the high voltage pressure switch 70, and sends out the water which flowed in from the carrier water pans 74 and 76 to a sprinkler 88 through a feed pipe 86. The feed water to a sprinkler 88 is controlled by the solenoid valve 90. Based on the signal from the high voltage pressure switch 70, this solenoid valve 90 is interlocked with a drain pump 82, and is opened and closed.

[0017] In addition, the outdoor fan 94 is formed as the indoor fan 92 and a fan who ventilates a condenser 54 as a fan who ventilates an evaporator 50.

[0018] Next, actuation of this freezer is explained. The refrigerant liquid made into low voltage to expand by the expansion valve 72 as mentioned above is supplied to an evaporator 50. In case refrigerant liquid has a cooling pipe in an evaporator 50 let it pass, it takes heat from the air ventilated by the indoor fan 92, evaporates, and can perform cooling etc. by supplying this cooled air to the interior of a room. In addition, thin tubing is used for a cooling pipe, in order to enlarge a touch area with air and to raise efficiency of heat transfer. By cooling air with an evaporator 50, the saturated water vapor pressure of the air concerned falls. The saturated steam dews on the surface of a cooling pipe, and if this dew condensation grows, it will serve as waterdrop and will be dropped from a cooling pipe. The carrier water pan 74 arranged under the evaporator 50 receives the waterdrop which the steam in this air solidified, and are collected.

[0019] The refrigerant which evaporated with the evaporator 50 and changed into the gas condition is led to a compressor 52 through gas piping 56. A compressor 52 is driven by the source of external power, compresses a refrigerant gas adiabatically, and makes it the refrigerant gas of overheating. Incidentally, although a compressor is divided roughly into classes, such as a reciprocation type, a rotating type, and a screw type, a suitable thing is selected by conditions, such as refrigerating capacity needed, and it is used for the compressor 52 used here.

[0020] The refrigerant gas made into overheating with the compressor 52 is sent out to gas piping 58. The another side edge of this gas piping 58 is connected with the condenser 54. A condenser 54 performs heat dissipation to atmospheric air from the refrigerant gas produced with the evaporator, liquefies a refrigerant gas, and uses it as refrigerant liquid. To the outside surface of tubing with which it lets the refrigerant in a condenser 54 pass, or a container, it is ventilated by the outdoor fan 94 and this promotes the heat dissipation to atmospheric air from the refrigerant gas produced with the evaporator. The refrigerant liquid produced with the condenser 54 is led to an evaporator 50 through the liquid piping 60.

[0021] Now, an OAT follows on going up, the heat dissipation effectiveness from the refrigerant in a condenser 54 to atmospheric air falls, and the effectiveness of liquefaction of the refrigerant in a condenser 54 also falls. Lowering of the effectiveness of a condenser 54 raises the pressure of the refrigerant in gas piping 58. In this freezer, the degradation of the condenser 54 accompanying OAT lifting is detected based on the high voltage pressure switch 70 having become beyond the threshold to which the discharge pressure of a compressor 52 was set beforehand.

[0022] The high voltage pressure switch 70 performs starting of a drain pump 82 and control to the open condition of a solenoid valve 90 while it will control the change valve 80 and will connect the catchment tubing 78 to a drain pump 82, if the degradation of a condenser 54 is detected. The drain water which the steam in air condensed and was filled in the carrier water pan 74 by this is supplied to a sprinkler 88, and is sprinkled by the outside surface of a condenser 54. Since the cooling effectiveness of a condenser 54 improves and the output side pressure of a compressor 52 declines by sprinkling water to a condenser 54, the consumption energy consumed with the outdoor fan 94 or a compressor 52 decreases.

[0023] Drawing 2 is drawing showing one example of the power consumption property of a compressor 52. In drawing, an axis of ordinate expresses the relative value of power consumption, and an axis of abscissa expresses the high-tension-side pressure of a compressor 52. The dotted line 100 in drawing is a power consumption characteristic curve at the time of water spray [which does not perform water spray from a sprinkler 88] operation to which it is usually a power consumption characteristic curve at the time of operation, and a continuous line 105, on the other hand, carries out water spray from a sprinkler 88. Usually, the inclination for the effectiveness of the power consumption reduction by water spray operation in comparison with operation to become so large that a high-tension-side pressure be large is seen. In this freezer, in response to such an inclination, when a high-tension-side pressure is beyond a predetermined value, it is supposed with the high voltage pressure switch 70 that water spray operation is performed. Incidentally, in case the predetermined value is determined, not only the reduction effectiveness of the power consumption of the compressor 52 by water spray operation but other factors can be taken into consideration. For example, although the power consumption by the drain pump 82 is small if it is generally measured against the power consumption of a compressor 52, it is good also as

determining the threshold of the high-tension-side pressure of whether to perform water spray operation based on the total power consumption which took this into consideration.

[0024] The drain water sprinkled by the condenser 54 from the sprinkler 88 is dropped from a condenser 54, and can be received in the carrier water pan 76. In this freezer, the drain water collected in this carrier water pan 76 can be led to a drain pump 82 with the catchment tubing 78, and it can reuse to spraying to a condenser 54. When a limitation is in the amount of the drain water generated in an evaporator 50 side like [in case an evaporator 50 is arranged by circulation reuse of this drain water in the closed interior of a room without the source of release of a steam], the consumption energy reduction actuation by spraying of the drain water to a condenser 54 can be continued.

[0025] In addition, when drain water is generated so much, the change valve 80 can be changed to an exhaust port 84 side, the drain water for needlessness can be discarded, and it can avoid that drain water overflows from the carrier water pans 74 and 76. Moreover, in order that the inside of air, the contaminant of evaporator 50 and condenser 54 front face, etc. may prevent it being mixed with drain water and producing plugging of the pipe line or a sprinkler 88, it is good for a part for the connection of the carrier water pans 74 and 76 and the catchment tubing 78 etc. also as preparing the filter from which a contaminant is removed.

[0026]

[Effect of the Invention] According to the freezer of this invention, since an evaporation type condenser is constituted, the steam in the air solidified on an evaporator front face is used as water sprinkled by the condenser front face. Since fused salt is not contained in this water condensation, it is prevented that a hard scale adheres to a condenser front face, and decline in the efficiency of heat transfer to the exterior arises from the refrigerant inside a condenser. Therefore, in the evaporation type condenser by this invention, even if it uses it for a long period of time, the effectiveness that the effectiveness of the power consumption reduction is demonstrated certainly is acquired.

[0027] Moreover, in order to use water condensation, it is effective in the cost of water itself not occurring.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the refrigerating cycle in the freezer which is the operation gestalt of this invention.

[Drawing 2] It is drawing showing one example of the power consumption property of a compressor.

[Drawing 3] It is the block diagram of the outline of the refrigerating cycle in the conventional freezer using an evaporation type condenser.

[Description of Notations]

50 An evaporator, 52 A compressor, 54 A condenser, 70 74 A high voltage pressure switch, 76 A carrier water pan, 78 Catchment tubing, 80 A change valve, 82 A drain pump, 88 sprinklers, 90 Solenoid valve.

[Translation done.]